BEFORE THE
PUBLIC SERVICE COMMISSION
OF WISCONSIN

Joint Application of Wisconsin Power and Light Company and Wisconsin Electric Power Company for Certificate of Authority for Edgewater Generating Station Unit 5 NO_x Reduction Project

Docket No. 5-CE-137

PRE-FILED DIRECT TESTIMONY OF

Randy D. Bauer

FOR

WISCONSIN POWER AND LIGHT COMPANY

October 20, 2009

Q. Please state your name, business address and employment.

A. My name is Randy Bauer. My business address is 200 First Street, SE, Cedar Rapids, Iowa 52403.

Q. By whom are you presently employed and in what capacity?

A. I am employed by Alliant Energy Corporate Services, Inc. (AECS), a service company subsidiary of Alliant Energy Corporation (Alliant Energy). My job title is Director of Asset Strategy and Generation Systems Operations. My responsibilities include responsibility for transmission planning activities and strategies, distribution system planning, integrated resource planning, operation of the generation dispatch center, and renewable energy portfolio planning. In this position, most of my time is spent working for Alliant Energy's wholly-owned

utility subsidiaries, Interstate Power and Light Company (IPL), and Wisconsin Power and Light Company (WPL).

Q. On whose behalf are you testifying?

A. I am testifying on behalf of WPL.

Q. What is your educational background?

A. I attended Kirkwood Community College and Mount Mercy College, both in Cedar Rapids. I have attended numerous short courses and seminars on planning and planning related issues**.**

Q. Please summarize your professional background and qualifications.

A. I have been employed by AECS or its predecessor companies since May of 1977. My experience includes assignments in the electric system planning area as well as Field Operations analysis. I have served on various Mid-Continent Area Power Pool (MAPP) Committees and Working Groups as well as various planning groups within the State of Iowa. Prior to my present position, I was Manager of Delivery System Planning from August 1996 through February 2004 with responsibilities for supervision of the IPL planning function for system facilities below 100 kV. I was named Manager of Asset Strategy in February 2004. I was promoted to my current position in December 2007.

Q. Have you testified before the Public Service Commission of Wisconsin before?

A. Yes.

Q. What is the purpose of your testimony?

A. The overall purpose of my testimony is to present the results of an economic analysis WPL performed to determine whether installing a Selective Catalytic Reduction (SCR) system for nitrogen oxide (NO_x) removal on Edgewater Unit 5 is a favorable alternative to retiring Edgewater Unit 5 to become compliant with the Reasonably Available Control Technology (RACT) rule.

Q. Are you sponsoring an exhibit as part of this filing?

A. Yes. I am sponsoring the following Exhibits:

Exhibit 1.2 (RDB-1): Electric Generation Expansion Analysis System (EGEAS) Present Value of Revenue Requirements (PVRR) Results;

Exhibit 1.3 (RDB-2): EGEAS Expansion Plans (Plan 1 and 2, Future 1);

Exhibit 1.4 (RDB-3): Break-Even Analysis; and

Exhibit 1.5 (RDB-4): WPL CO_2 Allowance Price Projections. .

Q. In general, what were the results of your analysis?

A. This analysis shows that installing a SCR system for NO_x removal on Edgewater Unit 5 is a favorable alternative to retiring Edgewater Unit 5 to become compliant with the RACT rule.

Q. What tools did WPL use to perform this analysis?

A. WPL used the EGEAS model.

Q. Could you briefly describe the EGEAS model?

A. EGEAS is an accepted computer model designed, in part, to determine an optimal, least-cost, electric generation fleet expansion plan that integrates alternative demand- and supply-side resources. The model will also calculate the

annual detailed production costs associated with the optimal plan. Inputs to the EGEAS model generally include:

- forecasts of load and energy requirements;
- characteristics of
    - energy efficiency projections;
    - existing generation resources;
    - potentially new resources including off-system purchases and generating plant (planning alternatives);
- on-going and expected wholesale energy sales and purchases;
- fuel, operating, and emission allowance cost projections; and
- system reliability constraints.

Based on the inputs and modeling specifications, EGEAS produces a generation expansion plan which satisfies system load and operating requirements while minimizing the Present Value Revenue Requirement (PVRR). In this analysis, the PVRR is calculated over a 30-year study period with a 35-year extension period and provided in 2008 dollars.

Q. How are the PVRR results used in the analysis?

A. Generally, differences in PVRR values between modeled plans are used to determine impacts on customer costs and measure the value of the least-cost plan. The greater the magnitude of a modeled plan's PVRR, the greater the impact on customer costs.

Q. How was EGEAS used to analyze the proposed installation of the SCR at

Edgewater Unit 5?

A. The EGEAS model was used to test the decision to install an SCR on Edgewater Unit 5 against retiring the unit prematurely. Specifically, WPL modeled the following two plans:

Plan 1: Install an SCR on Edgewater Unit 5 in the Spring of 2011 and;

Plan 2: Do not install an SCR on Edgewater Unit 5, and retire this unit at the end of 2012.

Q. Did WPL test any other plan in its analysis?

A. Yes, a third plan was specified for informational purposes in which the SCR was assumed to be installed in 2011 and a bag house and scrubber are installed in 2014 (Plan 3). This plan was modeled to demonstrate the potential effects of Edgewater Unit 5 with controls installed to mitigate other emissions, including NO_x, Mercury, Particulate Matter, and SO_2. It is important to note these controls are not necessary to comply with any current regulations.

Q. Explain how these three plans were evaluated in the EGEAS analysis.

A. The three plans were tested under 12 different views of the future, allowing WPL to examine the cost-effectiveness of its proposal under a wide range of possible futures.

Q. Please describe the 12 alternative futures analyzed by WPL.

The 12 futures examined can be briefly described as follows:

- **Future 1.** Future 1 includes all current emission rules and controls to comply with these rules and regulations.

- **Future 2.** Future 2 contains future 1 assumptions and includes CO_2 monetization at levels used by PSCW Staff in Docket No. 6680-CE-170.
- **Future 3.** Future 3 includes assumptions that would generally be favorable to the project. Assumptions include natural gas prices higher by 30%, coal prices lower by 10%; and project costs that fall 10% below the estimate.
- **Future 4.** Future 4 includes assumptions that would generally be unfavorable to the project. Assumptions in this future include: Natural gas prices lower by 10%; coal prices higher by 30% and the project costs exceed the estimate by 20%.
- **Future 5.** Future 5 can be considered "Carbon Constrained Future A". In this future, CO_2 is monetized at levels used by PSCW Staff in Docket No. 6680-CE-170, and fuel cost and policy impacts are consistent with CO_2 monetization.
- **Future 6.** Future 6 can be considered "Carbon Constrained Future B". In this future, all parameters the same as Future 5 except CO_2 monetization is consistent with WEPCO's method in the Glacier Hills wind farm application, Docket No. 6630-CE-302.
- **Future 7.** Future 7 has all parameters the same as Future 6, except adds new "zero carbon emitting resources priced at nuclear" in year 2025 for higher CO_2 reduction, and does not allow the model to choose new coal plants.
- **Future 8.** Future 8 uses future 1 assumptions and lowers gas prices by 10%.
- **Future 9.** Future 9 uses future 1 assumptions and raises gas prices by 10%.

- **Future 10.** Future 10 uses future 6, or "Carbon Constrained Future B," assumptions for CO2 monetization, prices gas and coal at future 1 prices and sets purchase power market prices consistent with gas and coal prices.
- **Future 11.** This future is the same as Future 10 with the exception of gas prices. In this future, gas prices are lowered by 10%.
- **Future 12.** This future is the same as Future 10 with the exception of gas prices. In this future, gas prices are raised by 10%.

Exhibit No. 1.2 (RDB-1) provides a more detailed description of the twelve futures as well as the PVRR results of the EGEAS runs for Plans 1 through 3 and Futures 1 through 12.

Q. Which set of EGEAS runs are you supporting in this testimony?

A. I am supporting the last set of EGEAS runs which were submitted in WPL's Third Supplemental Response to PSCW Staff DR 3.22 on June 5, 2009, contained in the table titled, "Wisconsin Power and Light Response to Public Service Commission of Wisconsin Staff Data Request No. 3.22, Attachment F (Public) Corrected Updated Analysis Present Value of the Revenue Requirements." The PVRR results of these EGEAS runs are shown in Exhibit No. 1.2 (RDB-1). Expansion plans for Plans 1 and 2, Future 1, are shown in Exhibit No.1.3 (RDB-2). I am also supporting the break-even runs submitted in WPL's Third Supplemental Response to PSCW Staff DR 3.22. The results of the break-even runs are shown in Exhibit No. 1.4 (RDB-3).

Q. What is the purpose of the break-even analysis and how was it performed?

A. The break-even analysis is used to determine how long after the SCR is installed that WPL's customers will begin to realize positive economic benefits, as measured in EGEAS, from the SCR installation versus retiring Edgewater unit 5 in 2012. Positive economic benefits occur when the difference in system-wide PVRR becomes positive between the following two scenarios:

- The scenario in which an SCR is installed on Edgewater Unit 5 and the unit is retired prematurely, after 2012, and
- The scenario in which the SCR is not installed and the unit is retired at the end of 2012.

The break-even time period was determined using graphical extrapolation. Ordered pairs of the number of years following the SCR installation year (4, 9, and 14 years on the x axis) and corresponding PVRR differences (y axis) were plotted. A line connecting these points was drawn. The point at which this line crosses the x axis signifies the time after the SCR is installed that WPL and its customers will begin to realize positive economic benefits, as measured by EGEAS. This graph is also provided in Exhibit No. 1.4 (RDB-3).

Q. What were the results of the break-even analysis?

A. The break-even analysis for WPL's future 1 under the decision model described above shows that WPL's customers are expected to start realizing positive economic benefits 6 ½ years following SCR installation.

Q. Were the Edgewater Unit 5 costs and characteristics that impacted the EGEAS analysis varied according to each plan modeled?

A. Yes. Edgewater Unit 5 cost and characteristics, including but not limited to capital revenue requirements, O&M costs, unit capacity, efficiency ratings and emission rates were varied according to each plan modeled.

Q. Please describe how the Edgewater Unit 5 capital revenue requirements and O&M costs were handled for the different plans.

A. Capital revenue requirements are specified for ongoing capital plant investments, sunk, and decommissioning costs, based on a modeled retirement date, as well as capital costs of emission control equipment, depending on which plan is modeled. O&M costs are specified for Edgewater Unit 5 as it exists in the base year, 2008, and for subsequent years depending on the plan modeled. Plan 1 adds O&M costs for the SCR, while in Plan 3, O&M costs are added for the SCR, baghouse, and scrubber. Plan 2 adds no additional O&M costs as the unit is presumed retired.**Q. Why did WPL specify capital revenue requirements for the mature and premature retirement plans for Edgewater Unit 5?**

A. The comparative analysis between mature retirement (Plans 1 and 3) and premature retirement (Plan 2) requires that all costs, not just variable operating costs, subject to recovery, be considered in the comparison. As such, revenue streams were specified to reflect ongoing capital plant investments, sunk, and decommissioning cost recovery by the date of retirement / replacement. These costs were specified to be recovered within the planning horizon modeled if the retirement date extended beyond the planning horizon, as is the case for the mature retirement for Edgewater Unit 5.

Q. What is the assumed operating life of Edgewater 5?

A. In this study, Plans 1 and 3, Edgewater Unit 5 is assumed to be retired at the close of 2045.

Q. What is the heat rate efficiency for Edgewater Unit 5?

A. Between 2003 and 2008, the average heat rate (btu/kWh) for net generation has ranged between 10,081 (2003) and 10,588 (2006).

Q. How does the heat rate for Edgewater 5 compare to heat rate efficiencies of other base-load coal-fired generating units serving Wisconsin?

A. Based on the data in Exhibit No. 68 in Docket No. 6630-CE-299 which compares the average heat rates (BTU/kWh) for 20 of the largest generating units in eastern Wisconsin, the 3-year average shows Edgewater Unit 5 as having a heat rate in the top 30% portion of the generators compared. The 5- and 10-year average shows Edgewater Unit 5 as having a heat rate in the top 35% portion.

Q. What changes to the characteristics of Edgewater Unit 5 were made to account for the different plans?

A. Edgewater Unit 5 was modeled with heat rate changes and capacity rating changes corresponding to the plan modeled based on engineering estimated impacts. The heat rate under Plan 1 increases by 0.36% from the base level with the addition of the SCR and, in Plan 3, increases by 1.23 % from the base level with the addition of the SCR, baghouse and scrubber. Capacity decreases by 0.35% or 1.446 MW from the base level with the addition of the SCR in Plan 1 and decreases 1.21% or 4.976 MW from the base level with the addition of the

SCR, baghouse and scrubber in Plan 3. Additionally, the model includes emission rate changes associated with the emission controls modeled in each plan. Changes in emission rates are specified using multipliers in the EGEAS model.

Q. Did WPL take into account factors like a Renewable Portfolio Standard (RPS), potential future carbon regulation, demand-side management (DSM) and available MISO market energy purchases in its EGEAS analyses?

A. Yes.

Q. How did WPL take into account a RPS in the EGEAS analysis?

A. Two renewable portfolio standards were considered in the analysis. First, in all Futures except 5, 6, and 7, the Wisconsin RPS requirement was modeled according to the specified load forecast. Second, in Futures 5, 6, and 7 an RPS, using the Governor's Task Force on Global Warming as a guide, was modeled to incrementally add renewable generation so that 25% of energy requirements, based on the specified load forecast, are satisfied by renewable resources by year 2025. Both of these RPSs were satisfied using wind generation. In both cases, generic new wind was allowed to be economically selected over and above the respective RPS requirement.

Q. How did WPL account for potential future carbon regulation?

A. In Futures 2 and 5, CO_2 allowances were modeled identical to a set of values used by Commission staff in Nelson Dewey 3 Docket No. 6680-CE-170 and which was used in the Columbia 1 and 2 CA Docket No. 05-CE-138. In Futures 6, 7, 10, 11, and 12, CO_2 allowances were modeled consistent with WEPCO's method

in Docket No. 6630-CE-302. The CO_2 allowance costs are accounted for in the dispatch of the units. The CO_2 allowance costs are listed in Exhibit No. 1.5 (RDB-4)

Q. How did WPL's EGEAS runs include the impact of conservation and DSM?

A. Existing levels of energy efficiency are included in the analysis through the energy load forecasts. Existing levels of DSM impacts such as interruptible load and direct load control are included through the peak load forecasts, modeling of units, or both.

Q. How were MISO market energy purchases modeled in the EGEAS analysis?

A. WPL modeled two supply-side economy energy purchases reflecting MISO LMP prices. Two generating resources with no reserve capacity value represent energy purchases for base load, "Base Economy", and peaking resources, "Other Economy". Prices for these energy purchases were updated commensurate with fuel price changes.

WPL used representative CO_2 emission input rates for the NERC Region Midwest Reliability Organization foot-print to account for the effects of CO_2 emissions on the MISO market energy purchases. The Emission and Generation Resource Integrated Data Base for 2007 (eGRID2007) is the data source. The CO_2 emission rate for Base Economy is based on a weighted average for coal and natural gas, whereas the CO_2 emission rate for Other Economy is based on natural gas.

Q. What were the results of the EGEAS analysis as displayed in Exhibit 1.2

(RDB-1) and how should these results be interpreted?

A. As noted, the basic decision modeled in this case is: should WPL install an SCR on Edgewater Unit 5 or retire the unit?

One comparison of this decision modeled in EGEAS is the comparison of the PVRR between Plans 1 and 2 under Future 1, where current conditions are assumed. The PVRR of these two plans are:

- Plan 1: $ 14,638.6 million
- Plan 2: $ 15,255.1 million

The difference between these PVRR is $616.5 million.

Another comparison of this decision modeled in EGEAS is the comparison of the PVRR between Plans 1 and 2 under Future 5, where CO_2 is monetized. The PVRR of these two plans are:

- Plan 1: $ 17,953.9 million
- Plan 2: $ 18,585.2 million

The difference between these PVRR is $631.3 million.

From the perspective of the EGEAS analysis I am supporting in this case as presented in Exhibit No. 1.2 (RDB-1), the appropriate course of action would be to adopt the plan with the lower PVRR. In these two futures, the plan to install an SCR on Edgewater Unit 5 has the lower PVRR. From a "compliance-by-investment" of an SCR perspective, it means that WPL's customers will save $616.5 million under Future 1, and save $631.3 million under Future 5, relative to a decision to retire the unit at the close of 2012 and investing in alternative

generation resources.

Q. How would you interpret this difference from a retirement perspective?

A. From a "compliance-by-retirement" perspective, the $616.5 million difference in Future 1 and the $631.3 million difference in Future 5 means that WPL's customers would pay a premium of $616.5 million or $631.3 million in Future 1 or Future 5, respectively, to forego installation of an SCR in order to invest in alternative generation resources to meet projected loads and energy needs.

Q. How many of the futures in Exhibit No. 1.2 (RDB-1), show that Plan 1, installing an SCR, is preferable to Plan 2, prematurely retiring Edge 5?

A. All twelve futures in Exhibit No. 1.2 (RDB-1) show that the PVRR for the "compliance-by-retirement" scenario would be more expensive for WPL's customers. This premium ranges from $32.6 million to $776.9 million.

Q. How many of the futures in Exhibit No. 1.2 (RDB-1), show that Plan 3, installing an SCR, baghouse and scrubber, is preferable to Plan 2, prematurely retiring Edge 5?

A. Nine out of the twelve futures in Exhibit No. 1.2 (RDB-1) show that the PVRR for the "compliance-by-retirement" scenario, Plan 2, would result in a cost premium to WPL and its customers relative to fully controlling the unit. This premium ranges from $7.0 million to $471.5 million.

Q. In what perspective should these costs and savings be considered in the EGEAS analysis you are supporting?

A. The costs and savings presented in this analysis are WPL company-wide

incremental calculations based on the assumptions made in the EGEAS model. Specific impacts on customer rates are a function of many factors such as the total rate base and expenses that is takes to serve WPL's customers. These totals are not captured by the EGEAS analysis. The costs and savings described in the EGEAS analysis represent the incremental costs to acquire generation resources and operate the existing and projected generation resources under various plan/future combinations.

Q. When a utility requests a CA for a project as WPL has done in this case, 196.49(3)(b) states the Commission may refuse to certify the project if (a) if the project will substantially impair the efficiency of the service of the public utility, (b) if the project will provide facilities unreasonably in excess of the probable future requirements, or (c) if the project adds to the cost of service without proportionately increasing the value or available quantity of service. In your opinion, do any of these three conditions raise concerns with respect to the proposed project?

A. No.

Q. Do you believe that Plan 1, installing an SCR, is the least-cost alternative to serve WPL's forecasted load and comply with the RACT rule for Edgewater?

A. Yes.

Q. Does this conclude your prepared direct testimony?

A. Yes.